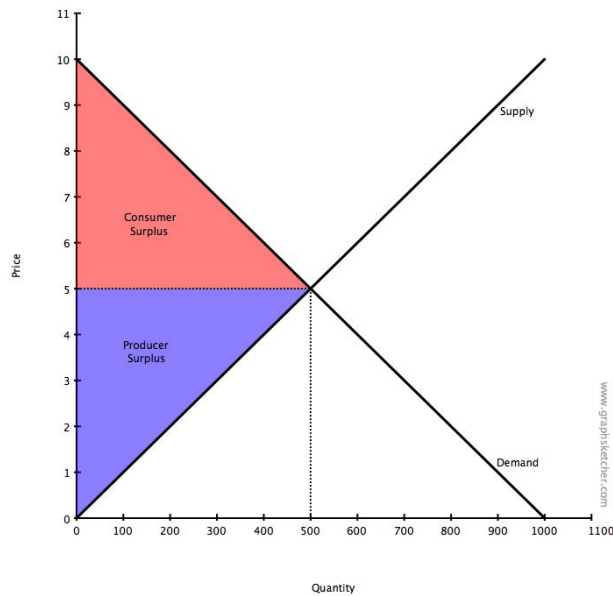## Consumer and Producer Surplus

In economics, we assume that trade is *mutually beneficial* for both the suppliers and consumers of a good. This benefit is typically placed into two categories, *consumer and producer surplus*.

Consumer surplus represents the benefit consumers gain from consuming a good. Graphically this is represented by the area underneath the demand curve and above the *price consumers pay for the good* (ie the difference between their willingness to pay for a good and the price they actually pay)

Similarly, *producer surplus* is the benefit producers gain from supplying a good. Graphically this is represented by the area below the *price producers receive for their good* and above the supply curve.

Example 1: Using the diagram above, calculate the consumer and producer surplus

Excise Taxes and Deadweight Loss

An *excise tax* is a tax which must be paid by suppliers for each unit of a good that they produce. This has the impact of shifting the supply curve to the left, increasing the price paid by consumers, and reducing the quantity sold in equilibrium. As a result of these changes, there is reduction in *total surplus*, which is the sum of producer and consumer surplus. This loss of surplus is called *deadweight loss*.

Tutorial: Solving Excise Tax Problems

In general, there are two methods that you can use to find the new equilibrium quantity after an excise tax has been imposed

Method 1: Shifting the Supply Curve

In this method, you shift the supply curve to reflect the change after the excise tax, and then solve for the new equilibrium quantity and price the traditional way.

Excise Tax – Economic Surplus
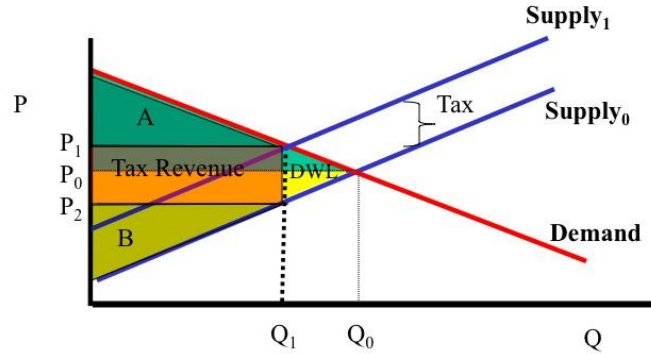
The excise tax as a *price shifter*. This means that for each quantity, the price increases by the amount of the tax for each quantity supplies. As a result, you must first solve the supply curve for the P variable, and then add the amount of the tax to the "equation side" to get the new curve:

$$P(after\ tax) = mQ + b + tax$$

Method 2: Differences in Prices

In this method, we use the following identity to solve for the equilibrium quantity:

$$P_D - Tax = P_S$$

Here, P_D represents the price that consumers are paying. P_S represents the price that suppliers receive. In order to use this method, you must first solve both the supply and demand equations for the P variable. Then, you substitute them into the above equation and solve the resulting equation for Q.

Once you have found the new equilibrium quantity, you can find the price that consumers are paying for the good by substituting Q into the demand equation, and the price that suppliers receive by substituting Q into the supply equation. The prices you find should satisfy the price identity listed above.

Tax revenue can be found using the following equation

$$Tax\ Revenue = Tax \cdot Equilibrium\ Quantity$$

Finally, deadweight loss can be calculated using the following formula:

$$DWL = \frac{1}{2}(P_D - P_S)(Q_0 - Q_1)$$

Where P_D is the price consumers are paying for the good with the tax, P_S is the price suppliers receive after the tax, Q_0 is the equilibrium quantity when there is no tax, and Q_1 is the equilibrium quantity with the tax.

Example 2: Suppose that the supply and demand in a given market are characterized by the following equations:

$$P_D = 20 - Q$$

$$P_S = 4 + 3Q$$

Suppose an excise tax of 4 dollars per unit is imposed in this market. What is the new equilibrium quantity in this market? What is the price consumers pay for the good? The price producers receive? What is the DWL resulting from this tax? What is the tax revenue generated by this policy?

Supply and Demand in an Open Economy

Imagine that we open up a domestic market to imports/exports. In introductory economics, we assume that an unlimited amount of the good can be imported/exported at a fixed *world price*.
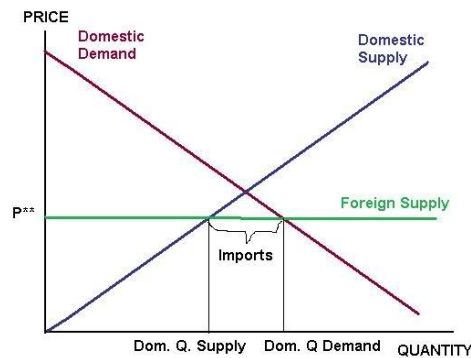
Given a world price, the difference between the quantity demanded and the quantity supplied represents the imports(exports) in the economy. Consumer and producer surplus are calculated in the same way as in a closed economy

Example 3: Suppose that the supply and demand in a closed economy is given as follows:

$$P = 30 - 2Q_d$$

$$P = 3Q_s$$

Now suppose the economy opens itself up to world trade and the world price is 12. Is this economy importing/exporting the good? How much are they importing/exporting?

Quotas and Tariffs in and Open Economy

There are two different forms of trade protection that a government can use in an open economy: *tariffs* and *trade quotas*. If the government uses a tariff, it results in a shift of the world price by the amount of the world price. From there, you can solve again for the amount of the good supplied/demanded by domestic firms/consumers, along with the amount of the good imported/exported by the economy. Tax revenue is found using the following formula:

$$Tax\ Revenue = Tax \cdot Imports$$

While DWL is found using the following formula:

$$DWL = \frac{1}{2}(P^{Tariff} - P^{World})[(Q^{D1} - Q^{D2}) + (Q^{S2} - Q^{S1})]$$
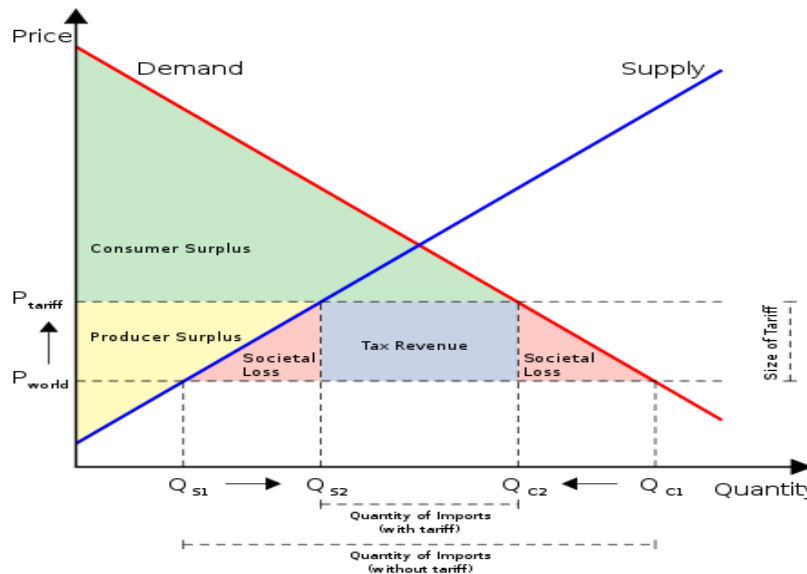
Example 4: Using the information from example three, presume that the government places a tariff of 3 dollars on the market. What is the new domestic demand? Domestic supply? What is the level of imports? What is the tax revenue and DWL?

In the case of a quota, the government limits the amount of imports to a specific number. There are two methods to find the new world price after a quote is imposed

Method 1: Shift the supply curve by the amount of the quota

If we assume that the imports will be equal to the amount of the quota, we can assume that at each price the *total supply* is increasing by the amount of the quota. After shifting the supply curve in this fashion the new equilibrium price can be found by solving the two resulting equations for the remaining unknowns.

Method 2: Differences in Quantities

In this method we use the following identity to solve for the new world price:

$$Q_D - Quota = Q_s$$

Where Q_D represents the demand curve solved for Q, and Q_s represents the supply curve solved for Q. By placing these equations into the above identity, you have an equation of one variable, which can be solved to find the new world price.

Note that there is no tax revenue here, but DWL can be calculated the same way as in the tariff scenario

Example 5: Using the information from example three, presume that the government imposes an import quota of 2.5 units on the market. What is the new equilibrium world price? What is DWL?

Practice Problems

1. Suppose that a small, closed economy opens its markets to trade. If the world price of good X is greater than the domestic price of good X we can predict that

a) This country will export good X to the world and domestic consumers will benefit from this additional trade.
b) This country will export good X to the world and domestic consumers will consume less good X.

Consider the small, closed economy of Milta. In the market for oranges in Milta you know the following:
Domestic Demand for oranges: $Q = 500 - 100P$
Domestic Supply of oranges: $Q = 50P - 100$
Furthermore, you know that the world price of oranges is $3.

2. If this market opens to trade, then the quantity of oranges supplied domestically will
a) decrease by 50 units.
b) be larger than the quantity supplied by foreign producers.
c) be smaller than the quantity supplied by foreign producers.
d) Answers (a) and (b) are both correct.
e) Answers (a) and (c) are both correct.

The demand and supply curves in the market for whiskey are given by the following equations:
 Demand: $QD = 120 - 3P$
 Supply: $QS = 2P$
Where Q is the quantity of whiskey in bottles and P is the price per bottle of whiskey. Suppose that the government in this economy has levied an excise tax of $5 on the suppliers of whiskey.

3. Given the above information and holding everything else constant, what is the deadweight loss resulting from the imposition of this excise tax?

 a.) $15   b.) $24   c.) $26   d.) $30

4. The tax revenue received by the government due to the imposition of this excise tax is equal to

 a.) $75   b.) $120   c.) $210   d.) $250

Use the figure below of the market for widgets to answer the **next two** questions.

Price of Widgets

Supply Curve

$35

$25

$5

Demand Curve

100

Quantity of Widgets
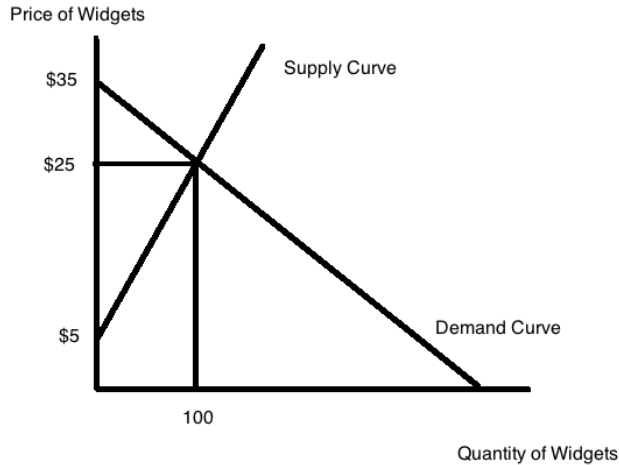
5. Consumer surplus in the market for widgets is equal to

a) $50   b) $2,500   c) $1,750   d) $1,000   e) $500

6. 17. Producer surplus in the market for widgets is equal to

a) $(35 * 100)   b) $(35 * 100 * 0.5)   c) $500   d) $1000   e) $2,000

Use the following information to answer the next **two** questions.

Consider the small, closed economy of Uropia. In Uropia the market for computers is characterized by the following demand and supply equations where Q is the quantity of computers and P is the price per computer:

Domestic Demand: $Q = 200 – (1/5)P$
Domestic Supply: $Q = (1/15)P – (40/3)$

Currently, the world price of computers is $320.

7. If the computer market is closed in Uropia, then the value of total surplus is _____, the equilibrium price in this market is _____, and the equilibrium quantity of computers in this market is _____.

a. $4000; greater than the world price of computers;40 computers
b. $800; greater than the world price of computers;40 computers
c. $16,000;greater than the world price of computers;40 computers
d. $16,000; less than the world price of computers;40 computers

8. Suppose that the government of Uropia decides to open this market to trade while simultaneously imposing a quota of 104 imports. Suppose the government wants to have the same impact on this market as this quota creates but instead use a tariff. What would the price of computers in Uropia with the tariff need to be in order to have the tariff and the quota create the same impact on this market?

a. The tariff would need to raise the price to $390.
b. The tariff would need to raise the price to $400.
c. The tariff would need to raise the price to $410.
d. The tariff would need to raise the price to $420.